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Research Article

Shoulder Pain in Hemiplegia Results from a National Rehabilitation Hospital in Turkey

ABSTRACT

Aras MD, Gokkaya NKO, Comert D, Kaya A, Cakci A: Shoulder pain in hemiplegia: Results from a national rehabilitation hospital in Turkey. *Am J Phys Med Rehabil* 2004;83:713–719.

Objective: Shoulder pain is a common complication after stroke that can limit the patients' ability to reach their maximum functional potential and impede rehabilitation. The aim of our study was to examine the occurrence of hemiplegic shoulder pain in a group of Turkish patients and clarify contributing factors such as glenohumeral subluxation, reflex sympathetic dystrophy, tonus changes, motor functional level, limitation in shoulder range of motion, thalamic pain, neglect, and time since onset of hemiplegia. The effect of shoulder pain on the duration of rehabilitation stay was also identified.

Design: A total of 85 consecutive patients with hemiplegia admitted to a national rehabilitation center were evaluated for the presence of shoulder pain. A brief history of pain was taken for each patient, and each patient was evaluated by radiographic and ultrasonographic examination. The subjects with shoulder pain were compared with those without pain in regard to certain of the above variables.

Results: Of the 85 patients with stroke, 54 patients (54/85, 63.5%) were found to have shoulder pain. Shoulder pain was significantly more frequent in subjects with reflex sympathetic dystrophy, lower motor functional level of shoulder and hand ($P < 0.001$), subluxation, and limitation of external rotation and flexion of shoulder ($P < 0.05$). Age was also a significant factor in the development of shoulder pain. We were unable to demonstrate a significant relationship between shoulder pain and sex, time since onset of disease, hemiplegic side, pathogenesis, spasticity, neglect, and thalamic pain. There was no prolongation of rehabilitation stay in patients with shoulder pain.

Conclusion: These results indicate that shoulder pain is a frequent complication after stroke and that it may develop from a variety of factors. To prevent and alleviate shoulder pain, efforts should be directed toward proper positioning of the shoulder, range of motion activities, and the avoidance of immobilization.

Key Words: Hemiplegia, Shoulder Pain, Shoulder Subluxation

Shoulder pain is a common problem after stroke; estimates of prevalence vary from 40–80% of newly developed cerebrovascular incidents.¹ The painful hemiplegic shoulder often complicates and prolongs rehabilitation in hemiplegia. Patients with hemiplegic shoulder pain remain hospitalized longer, and the shoulder pain complicates the rehabilitation process.^{2,3}

Progress in performing activities of daily life, walking, and functional recovery of the upper limb is often hampered.¹ In a study performed by Roy et al.,⁴ it was identified that hemiplegic shoulder pain affected stroke outcome in a negative way. They demonstrated that the presence of hemiplegic shoulder pain is strongly associated with prolonged hospital stay and poor recovery of arm function in the first 12 wks after stroke. A number of disorders have been proposed in the literature as being major causes of pain in the hemiplegic shoulder. These include glenohumeral subluxation,^{5,6} spasticity of shoulder muscles,^{7–9} impingement,^{10,11} soft-tissue trauma,¹¹ rotator cuff tears,^{12,13} and shoulder–hand syndrome or reflex sympathetic dystrophy.⁷ It was emphasized that all of these mechanisms have been suggested rather than established, and most authors consider the pathogenesis of the hemiplegic shoulder to be multifactorial.¹⁴

This study was developed to reveal the prevalence of shoulder pain and factors associated with shoulder pain among stroke patients at a national rehabilitation center in Turkey and to compare the results with other countries.

PATIENTS AND METHODS

Ankara Physical Medicine and Rehabilitation, Education, and Research Hospital, with its 200-bed capacity, is one of the largest national rehabilitation centers in Turkey. The

catchment area of this hospital is basically Central and Eastern Anatolia, but patients are accepted from all parts of Turkey, and this causes a considerable patient load. Patients are put on the waiting list, and the average time to admission is 4–6 wks. Home programs are given until the rehabilitation admission, or the initial physical therapy is performed at general hospitals under the supervision of rehabilitation physicians. Stroke patients constitute approximately 30% of the whole patient population at our hospital. The focus of the rehabilitation program for stroke patients is to optimize both functional independence and to educate the patient and the family regarding medical care and a daily exercise program. Rehabilitation consists of assessment and treatment by a multidisciplinary approach that consists of physiotherapy, occupational therapy, psychology services, speech therapy, nutrition, and dietary services. At the same time, treatment of complications related with stroke are carried out.

A total of 85 consecutive stroke patients (26 women, 59 men; mean age, 59.5 ± 11.6 yrs) admitted to our hospital were included in this study. Stroke was defined according to the World Health Organization criteria as follows: rapidly developed clinical signs of focal disturbance of cerebral function, lasting >24 hrs, with no apparent origin other than vascular.¹⁵ Stroke was diagnosed clinically by a neurologist and confirmed by computed tomography. We evaluated all patients for the presence of shoulder pain. Radiographs and ultrasonographs of both shoulders were obtained. Data including age, sex, side of involvement, pathogenesis of the lesion, duration of the disease, duration of rehabilitation stay, and comorbidities such as diabetes mellitus, heart disease, and hypertension were recorded, as were Brunnstrom recovery stages of the patients. All patients were examined accordingly for the

possible causes of shoulder pain to determine any possible relationship with the shoulder pain. A clinical diagnosis was then made regarding the shoulder problem, and the appropriate treatments were started, including medication, physiotherapy, electrotherapy, local injections, nerve blocks, and utilization of arm slings and lap boards.

Passive range of motion (ROM) of the affected shoulder was measured using a goniometer. ROM measurements included shoulder flexion and external rotation. For the purposes of data analysis, these variables were transformed to a scale indicating mild, moderate, or severe motion restriction, depending on whether the total range was <50%, 50–67%, or >67% of the normal for shoulder flexion and <22.2%, 22.2–33.3%, or >33.3% of the normal for shoulder external rotation, respectively.

Upper limb motor function was by assessed using Brunnstrom recovery stages. The lowest stage (flaccid stage and no voluntary movement) was stage I and highest stage (isolated joint movement) was stage VI. The validity and reliability of assessment using Brunnstrom recovery stages has been established.^{16,17}

Spasticity at the upper limb was evaluated on a 5-point Ashworth scale (range, 0–4).¹⁸ The scale is rated as follows: 0 = no increase in muscle tone; 1.0 = slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of ROM when the affected part is moved in flexion or extension; 2.0 = more marked increase in muscle tone through most of the ROM, but the affected part is easily moved; 3.0 = considerable increase in muscle tone and passive movement is difficult; and 4.0 = affected part is rigid in flexion or extension.

The reflex sympathetic syndrome (RSD) is a well recognized clinical syndrome characterized by diffuse distal limb pain, hyperesthesia, edema, dystrophic skin changes, and

vasomotor instability. The clinical diagnosis of "definite" RSD was made according to the guidelines established by Tepperman et al.¹⁹ and Davis et al.²⁰ Loss of ROM in the shoulder, especially abduction and external rotation; pain and tenderness elicited by these motions or in rest (severe cases), considerable pain on (limited) extension in the wrist; tenderness to deep palpation and dorsal edema over carpal bones, relatively little spontaneous pain or tenderness in the hand; edema overlying metacarpals, considerable pain on (limited) flexion of metacarpophalangeal and interphalangeal joints; moderate fusiform edema and loss of dorsal skin lines; changes in hair and nail growth; vasomotor and sudomotor lability (changes in temperature, color, and hidrosis) indicated the presence of RSD. Differential diagnosis was made by hand radiographs and a three-phase scintigraphic study if any suspicion of other factors such as positional edema or thrombophlebitis existed.

The presence of glenohumeral joint subluxation was assessed from anteroposterior radiographs centering on the glenohumeral joint with the hemiplegic arm unsupported by using previously explained methods.⁶

Ultrasonographic evaluations were performed with a 5–12 MHz lin-

ear transducer by the same radiologist who had the necessary expertise. The radiologist did not have any knowledge about the patients' clinical status. Evaluations were performed by both anteroposterior and lateral approach, and the joint was examined in axial, sagittal, and coronal planes. In all cases, the investigations included the long head of the biceps tendon, three rotator cuff tendons (supraspinatus, infraspinatus, subscapularis), subacromial and subscapularis bursae, and effusions in the shoulder joint complex.

Data were analyzed using an SPSS package (SPSS, Chicago, IL). Descriptive statistics of the patients' sociodemographic and clinical features and radiologic and ultrasonographic findings were calculated. The relationship between shoulder pain and sex, side of hemiplegia, type of stroke, glenohumeral subluxation, RSD, spasticity, flaccidity, neglect, and thalamic pain were calculated using Spearman's correlation coefficients. The relationship between shoulder pain and age, time since onset of disease, and duration of rehabilitation stay were calculated using Pearson's correlation coefficient.

Depending on whether distributions were normal, Student's *t* test was applied to compare groups with or without pain regarding demo-

graphic data and clinical features. To assess the relationship between pain and ROM of shoulder, analysis of variance was performed. A post hoc Tukey test was applied to identify which grade of shoulder motion restriction accounted best for the correlation between shoulder pain and motion restriction. The significance level was set at the 0.05 level.

RESULTS

A total of 85 stroke patients were evaluated, and 54 patients (54/85, 63.5%) were found to have shoulder pain at admission to the rehabilitation center. Table 1 shows demographics and data of the patient groups with or without shoulder pain. No significant differences were found between the two groups regarding these data, except for age. Although the disease duration was longer in the patient group with pain when compared with the patient group without pain, this did not reach statistical significance. The mean age of the patient group with shoulder pain was significantly higher than that of the patient group without shoulder pain ($P = 0.03$).

Almost all patients were found to have comorbidities such as hypertension (36/85, 42.4%), heart disease (10/85, 11.9%), and diabetes mellitus (4/85, 4.7%). Thirty-one percent (26/85) of the study group had more than one of the above diseases. There was no significant difference between the two patient groups in terms of comorbidities. There were also no significant differences between the two groups with respect to the presence of spasticity, neglect, and thalamic pain.

As we had expected, the factors associated with shoulder pain in our patients varied, and it was difficult to isolate just one specific cause. More commonly, several clinical diagnoses were involved in the development of shoulder pain. Of the 54 patients with shoulder pain, 27 patients (27/54,

TABLE 1

Data of the patient groups with and without shoulder pain

	Group		<i>P</i> Value
	With Pain	Without Pain	
Age, yrs	61.5 ± 10.3	56 ± 13.2	0.030
Sex			0.850
Female	16	10	
Male	38	21	
Side of involvement			0.605
Right	23	15	
Left	31	16	
Pathogenesis			0.355
Hemorrhagic	14	11	
Thromboembolic	40	20	
Duration of disease, days	70.2 ± 45.6	59.5 ± 49.9	0.321
Duration of rehabilitation stay, days	49.4 ± 23.8	50.4 ± 24.1	0.854

TABLE 2

Changes of structures examined with ultrasonography of the shoulder

Structure and Changes	Group	
	With Pain <i>n</i> (%)	Without Pain <i>n</i> (%)
Long head of biceps tendon (effusion, thickening, thinning/tears, total rupture, echotexture changes)	35 (64.8)	16 (51.6)
Subscapularis tendon (thickening, thinning/tears, total rupture, echotexture changes)	—	—
Supraspinatus tendon (thickening, thinning/tears, total rupture, echotexture changes)	35 (64.8)	13 (41.9)
Infraspinatus tendon (thickening, thinning/tears, total rupture, echotexture changes)	1 (1.8)	—
Subacromial bursa (effusion)	5 (9.2)	2 (6.5)
Subscapularis bursa (effusion)	—	—
Acromioclavicular or glenohumeral joints (effusion)	2 (3.7)	—

50%) showed various grades of glenohumeral joint subluxation, 25 patients (25/54, 46.3%) had RSD, 26 patients (26/54, 48.1%) showed signs of subacromial impingement and 27 patients (27/54, 50%) had tendinitis. Results of ultrasonographic evaluations in patients with or without shoulder pain are demonstrated in Table 2. Although the patients with shoulder pain were found to have more structural changes in several components of the shoulder joint complex compared with the patients without shoulder pain, this did not reach a statistically significant difference.

The Brunnstrom recovery stages of patients with shoulder pain *vs.* patients without shoulder pain are shown in Table 3. The Brunnstrom recovery stages of the two groups was significantly different ($P = 0.004$). The flaccid stage was also significantly related to the presence of shoulder pain ($P = 0.01$).

The presence of shoulder pain was related to the ROM measurements in shoulder flexion and external rotation. The prevalence of shoulder pain was significantly more frequent in patients with more severe motion restrictions in both flexion

and external rotation ($P = 0.006$). In the patient group with shoulder pain, there were 27 patients (50%) with glenohumeral joint subluxation compared with five patients (16.1%) with the same finding in the group without pain ($P = 0.002$).

Of the 54 patients with shoulder pain, 25 patients had RSD, whereas only one patient had the same diagnosis in the group without shoulder pain. There was a highly significant association between RSD and shoulder pain in this group of stroke patients. It was also found that the

patients with glenohumeral subluxation had a higher prevalence of RSD. Almost 60% of patients with subluxation had RSD at the same time. There was a significant correlation between these two variables ($P = 0.006$).

DISCUSSION

Shoulder pain is one of the most frequent complications of hemiplegia. The severity of pain in many patients makes it one of the most devastating sequelae to follow the initial neurological event. The cause of hemiplegic shoulder pain is a subject of considerable controversy. The associations of this complication in many patients may vary, and it is often difficult to isolate a specific cause. More commonly, several factors are involved, and this problem represents a multifactorial pathology that could probably be related with the complex functional and structural anatomy of the shoulder.

Although the relation between shoulder subluxation and shoulder pain in patients with hemiplegia remains controversial, shoulder subluxation is among the most commonly cited causes of shoulder pain in hemiplegia, with rates reported up to 81%.²¹ Shai et al.²² showed a strong association between chronic shoulder pain and subluxation. In their study, of the 19 patients with subluxation, 14 had pain compared with the three instances of pain among 11 patients with normal radiographic findings. They suggested that subluxation was the principal cause of pain in the shoulder in hemiplegia. De Courval et al.²³ reported that patients with shoulder pain had significantly more subluxation.

Van Ouyenaller et al.⁷ also stated that subluxation seemed to be responsible for the greatest number of pain complications of the shoulder. However, in a study of 100 consecutive patients with hemiplegia, Peszc-

TABLE 3

Brunnstrom recovery stages of the patient groups with and without shoulder pain

Stages	Group	
	With Pain, <i>n</i>	Without Pain, <i>n</i>
I	19	3
II	19	7
III	10	8
IV	3	7
V	3	4
VI	0	2

zynski and Rardin²⁴ indicated that there was no statistical difference in the amount of subluxation in patients with or without pain. Kumar et al.²⁵ reported a 46% rate of subluxation in their 28 cases, but no significant effect was noted in the development of pain.

Joynt²⁶ also failed to show a statistical relationship between the presence of subluxation and either the severity of the complaint or the amount of pain on passive movement. In our study, 50% of the hemiplegic patients with shoulder pain demonstrated subluxation, whereas only 16% of the patients without subluxation had shoulder pain ($P < 0.001$). However, we think that this finding is always not sufficient to indicate that the subluxation is the principal cause of hemiplegic shoulder pain. Prospective studies are needed to reveal whether pain starts after subluxation or the association of these two factors are also affected by other clinical findings such as age, tonus changes, and motor deficits.

Despite all these conflicting results, treatment of shoulder subluxation continues to be the standard of care in many rehabilitation facilities. Immediately after an upper motor neuron lesion such as stroke, the affected limbs become flaccid in approximately 90% of the patients.²⁷ The only structures left to protect and provide support for the glenohumeral joint at this stage are the joint capsule and ligaments. In the absence of muscle function, the pull of gravity on the arm will often cause the capsule to stretch, resulting in shoulder subluxation. Shoulder subluxation usually develops in the first weeks after hemiplegia.²⁷ Shoulder subluxation may cause pain directly or indirectly. Painful subluxation is difficult to refute when clinical shoulder subluxation is present without evidence of other pathology, pain is present when the upper limb is dependent, and pain abates with manual joint reduction. In addition,

shoulder subluxation may have a role in the pathogenesis of other painful conditions by stretching local neurovascular and musculoskeletal tissues and thus leading to immobilization and atrophy of rotator muscles. It has been suggested that there is a correlation between early subluxation and the subsequent development of shoulder pain.^{7,22} The downward traction of shoulder joint complex may be associated with an increased rate of inappropriate autonomic responses (i.e., RSD) in the upper limb.¹⁹ Occasionally, when traction is applied, damage to the brachial plexus and peripheral nerves may occur.²⁸ Subluxation may also inhibit functional recovery by limiting shoulder ROM.

In our study, besides shoulder subluxation, shoulder pain was significantly associated with the weakness of upper limb, flaccidity, severity of ROM restriction, and RSD. We think that these findings in this group of stroke patients might be a reflection of the above-mentioned mechanisms of shoulder pain after subluxation. Results of ultrasonographic evaluations in our patients were also consistent with the injuries that might be caused by subluxation in the shoulder joint complex structures like tendons and bursae. Ultrasonography reveals the different location of changes of the shoulder girdle. The girdle's complex anatomy makes it difficult to identify alterations by clinical examination, and the application of other diagnostic techniques such as magnetic resonance imaging is limited by high cost and limited availability of the equipment.²⁹ In contrast, ultrasonography is a noninvasive and low-cost imaging method that has been applied successfully in musculoskeletal medicine, especially in the evaluation of the rotator cuff. In our stroke patients, structural changes such as thickening, thinning/tears, echotexture changes, and effusion were mostly observed in biceps and su-

praspinus tendons. There were only two patients who had tears in the rotator cuff. However, it is stated that ultrasonography is less accurate in identifying partial-thickness tears,³⁰ so our percentage might be less than the actual percentage.

Although there were more structural changes in several components of shoulder joint complex in the pain group, this did not differ significantly from the patients' findings in the group without pain. This might be attributed to the inevitable changes of such structures with the increasing age in both patient groups, with or without shoulder pain, and to the changes in the musculoskeletal tissues because of the immobilization caused by stroke. Age was also a contributing factor in the development of shoulder pain.

In this study, the prevalence of RSD was 47%. Its prevalence has been reported in the literature as between 12.5% and 61%.^{7,19,20,31} This substantial variation can probably be explained by differences in definition and base population. A striking finding in our study was that almost all patients with RSD had shoulder subluxation, too. The association of glenohumeral joint subluxation and RSD is rarely mentioned in the literature, and there are a few recent studies with conflicting results.³¹⁻³³ We believe that the role of glenohumeral subluxation on the occurrence of RSD has yet to be established. The strong association of subluxation and RSD in our patient group confirms the results of two studies focusing on this issue; Dursun et al.³² found that the prevalence of glenohumeral subluxation was almost 2-fold in patients with RSD compared with patients without this diagnosis. Braus et al.³³ suggested that shoulder subluxation by itself might be a risk factor for developing shoulder-hand syndrome after stroke, in addition to upper limb weakness, moderate spasticity, and visual-perceptual deficits. It was concluded that although the influence of

all these potential confounders was unclear, these factors seem to have in common a higher risk of traumatizing the hemiparetic arm. On the other hand, Daviet et al.³¹ reported that shoulder subluxation, unilateral neglect, and depression did not seem to be the determinant predictive factors of complex regional pain syndrome severity; the prognosis of this pain syndrome was found to be directly linked to the prognosis of the hemiplegia. We think that the significant association between RSD and glenohumeral subluxation in our patient group might be partly attributed to the effect of delay between the stroke and rehabilitation admission. These patients probably did not have the preventative measures and the appropriate treatment of glenohumeral subluxation effectively early in the course of their disease, which is a frequent problem in our patients, especially in those who come from locations with limited medical sources. Our results showed that the time since stroke was higher in the group with pain when compared with the group without pain, but this did not reach statistical significance. It is worthwhile to study the occurrence and course of shoulder pain prospectively and its contributing factors from the first day of stroke to have a better idea about these associations in our patient population.

There was no significant correlation between shoulder pain and hemiplegic side, sex, pathogenesis, and duration of rehabilitation stay. During this study, we might have become more concerned about shoulder pain; hence, the treatments were more energetic and more adequate, resulting in the duration of the hospital stay not becoming prolonged.

CONCLUSIONS

Poststroke shoulder pain is a common complication in hemiplegia. The pathogenesis of shoulder pain varies, and it is often difficult to iso-

late a specific cause. More commonly, several factors are involved and create a multifactorial pathology. In this study, some of the various factors related to the occurrence of shoulder pain are lower motor functional level of the upper limb, flaccidity, shoulder motion restriction (especially in flexion and external rotation), glenohumeral joint subluxation, and RSD. Besides these factors, older age seems to be a contributing factor. Our results also suggest that glenohumeral joint subluxation may be a causative factor for RSD and, as a result, pain.

It is suggested that the efforts should be made from the first day of stroke to keep the shoulder in an ideal position at all times, and any delay before rehabilitation admission should be avoided. ROM activities of the upper limb, avoidance of immobilization, and the attention to the proper methods of handling a patient with a hemiplegic upper limb should be encouraged. In addition to these primarily preventive measures, energetic and appropriate treatments considering all contributing factors should be performed.

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